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ZANZIBAR PROTECTORATE.

ANNUAL REPORT

ON THE

PUBLIC HEALTH DEPARTMENT

FOR THE YEAR,

1916.

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ZANZIBAR PROTECTORATE.

REPORT ON THE PUBLIC HEALTH DIVISION

FOR THE YEAR 1916.

General Remarks.—Since the outbreak of war the work of the Public Health Division has suffered from depletions in staff, additional duties, suspension of special works, and undoubtedly from lack of close supervision and organization.

After the departure of Major Skelton, R.A.M.C., on active service in January, 1915, the post of Medical Officer of Health remained vacant, Dr. Carment, Assistant Medical Officer of Health, acting in that capacity until on July 3rd, 1916, he was permitted to terminate his temporary agreement for health reasons. Much of the former's time had been devoted to the training of a local corps of stretcher bearers who did excellent service in German East Africa, and of the latter's in experimenting with smoke bombs for H. B. M's. Ships in these waters. Two of the senior subordinates were still on active service throughout 1916, the Sanitary Inspector was absent on a much delayed privilege leave for the greater part of the year, and many of the best natives of special and mosquito gangs, etc. had gone as stretcher bearers.

For the greater part of the year both administrative and out-door work in spite of diminished staff of Medical Officers devolved upon the Principal Medical Officer with the assistance of Dr. Aders, Economic Biologist, who, in addition to his normal duties, those of acting Veterinary Officer and Censor, carried out microscopical diagnostic work.

Dr. McHattie, the newly appointed Medical Officer of Health, arrived on 13th October.

It has been abundantly proved that some most willing subordinates from lack of organization, instruction, definition of duties and supervision have entirely failed to grasp the town work expected of them. This state of affairs was rapidly being rectified by Dr. McHattie, Medical Officer of Health, at the close of the year.

Thus the year has been abnormal and it is considered that this annual report, while recording work accomplished, will serve a more useful local and general purpose if it embodies a more comprehensive survey of existing conditions, a wider view of the more urgent problems to be overcome, and the expressed opinions of the general sanitarian rather than of the specialist and statistician. An additional reason for this opinion is the fact that the reports from this

Protectorate have never yet been framed on the formula common to other Crown Colonies and Protectorates and that alterations in that established formula are officially announced for the near future.

The general health of the population of the Protectorate from the point of view of epidemic diseases has been satisfactory, but reference will be made to certain diseases and to unsatisfactory comparative records of births and deaths.

It has been impossible to undertake the detailing of a Town Planning Scheme as required by the Colonial Office but a useful general survey of the town and its sanitary requirements has been accomplished, a study of the many shipping, anchorage, customs, private, business and economic interests which must be considered in any such scheme has been constantly maintained, further useful work in acquiring open spaces by demolition of huts has been carried on, and a good scheme for acquiring and improving an area of the town as an European quarter has been evolved. The promised publication of a large scale map of the town will be of great assistance.

The species, habitats and life histories of our local mosquitos have been closely studied by Dr. Aders with the result that many established beliefs have been upset and certain existing anti-mosquito measures shown to be both futile and costly. Experiments and observations are still being conducted and a rational practical scheme for attacking both town and swamp breeding varieties promises to be the outcome.

In connection with the Abuse of Opiates Prevention Decree it is satisfactory to report that an average annual consumption of 1284 pounds in the four years 1910-1914 was already reduced to 170 pounds during the year.

It was found impossible to continue the usual course of Health Lectures but it is strongly urged that these should be recommenced as soon as existing conditions permit and that they should be extended to a far more representative audience than in past years.

VITAL STATISTICS.

Population.—No census has been taken since 1910 and there is reason to believe that the figures then recorded were not altogether reliable. The total population of the two Islands was stated to be 197,199 and that of Zanzibar Town itself to be 35,264.

BIRTHS.

(*a*) Number of births registered in the Town District of Zanzibar during 1916:—

Males	164	
Females	131	
Hermaphrodite	1	
		296
Still-born		20
Total		316

The total for 1915 was 361 of which 29 were still-born.

(*b*) Nationalities of births registered in the Town District of Zanzibar for 1916:—

Ismaili Khoja	85	Swahili	19
Banyan	39	Arab	13
Ithnasheri Khoja	38	Gazija	8
Bohora	21	Shihiri	6
Mohammedan Indian	20	European	5
Goan	20	Nyasa	1
Memon	19	Persian	1
		Others	1
		Total	296

Below is shown the annual recorded number of Swahili births in Town District for the last 6 years against those of the bigger Indian communities (Khoja, Banyan, Bohora, Memon and Mohammedan Indian):—

		1911	1912	1913	1914	1915	1916
Swahili	...	207	151	91	24	28	19
Indian	...	254	236	373	342	240	222

It will be noted that births amongst bazaar Indians remain fairly stationary, those of Swahilis have fallen from 207 to 19 in 5 years.

It is persistently urged that there is no cause for alarm, that the native birth rate is satisfactory, and that only the records of births are at fault. The above figures, for what they are worth, are not due to diminishing town population, do not suggest that pregnant native mothers are increasingly seeking out-districts for their confinements, and cannot solely be due to increasing inefficiency of system of birth registration.

(*c*) Total number of births registered in the Island of Zanzibar since 1910:—

Districts		1916	1915	1914	1913	1912	1911	1910
Town District	...	296	332	401	576	518	580	378
Mkokotoni District	...	1099	1023	511	634	580	640	529
Chwaka District	...	490	426	245	287	251	348	387
Mwera District	...	469	458	190	253	186	246	273
Total	...	2354	2239	1347	1750	1535	1814	1567

A slightly greater number of births in each of the out-districts is shown over those for 1915 and for each a bigger figure than recorded in previous years.

It may be presumed that records of deaths are fairly accurate since relations have something to gain in the division of property, and as certainly the records of births are inaccurate and much below their true figure, but even so the following comparative figures are not satisfactory for a Protectorate entirely dependent upon native labour.

	1913		1914		1915		1916	
	Births	Deaths	Births	Deaths	Births	Deaths	Births	Deaths
Town District ...	576	1022	401	1239	332	1008	296	1168
Out-Districts ...	1174	1983	946	1821	1907	2212	2058	2089
Totals ...	1750	3005	1347	3060	2239	3220	2354	3257

This table shows an increase in total recorded births from 1750 to 2354, an increase in deaths from 3005 to 3257 in the last four years; the figures for 1916 show an excess of deaths over recorded births of 903. If the error in registration of births is 50 per cent and if only half the actual births are recorded, the figures for deaths being accepted as accurate, then the births should be 4708 giving an excess over deaths of 1451.

A more thorough and accurate method of registration of births both in town and out-districts is promised for next year and it is hoped may show a more satisfactory state of affairs as actually existing.

DEATHS.

(*a*) The number of deaths registered in the Town District during 1916 was:—

Males	611	
Females	496	
Hermaphrodite	1	
	Total	1108

An increase of 153 over the deaths for 1915.

(*b*) Ages of the deceased in Town for last 4 years:—

	1916	1915	1914	1913
Under one year.	93	82	123	81
1 to 5	68	46	70	56
6 „ 10	10	19	32	32
11 „ 20	59	45	77	46
21 „ 30	159	124	202	151
31 „ 40	230	204	237	207
41 „ 50	171	148	198	152
51 „ 60	95	80	77	94
61 „ 70	57	61	37	70
Over 70	165	141	170	133
Unknown	1	5	16	...
	1108	955	1239	1022

A study of these figures for the total deaths of all nationalities in Zanzibar Town District shows that a steady 35 per cent of the total deaths occur between the ages of 21 and 40 years, and that a further 14 per cent occur between birth and 5 years of age.

(*c*) Nationality of the deceased in Town District:—

Swahili	598	Baluchi	10
Ismaili Khoja	98	Mnyamwezi	10
Gazija	58	European	8
Shihiri	53	Goan	6
Mohammedan Indian	50	Manyema	3
Arab	44	Nyassa	3
Ithnasheri Khoja	40	Parsee	3
Banyan	39	Somali	2
Bohora	25	Kikuyu	1
Memon	19	Others	38

——Total 1108.

(*d*) GENERAL CAUSES OF DEATH IN ZANZIBAR TOWN DISTRICT.

In the annual report of the Medical Division reference is made to particular diseases based on Government Hospital and Dispensary returns of patients.

For many years past comparisons of incidence of certain diseases in the annual report of the Public Health Division have been based on the diagnoses of causes of death contained in the death reports of persons dying within the Town District. Such have been entirely fallacious owing to the fact that the majority of persons dying are never seen by qualified doctors but only after death by an unqualified subordinate who attempts to arrive at a diagnosis by a survey of the corpse and by questioning of the household as to symptoms.

This Inspector of the Dead was appointed to prevent the concealment of deaths from Small-pox, Plague, etc., and his services in that direction are certainly valuable, but to seriously record diminution of incidence of Tuberculosis, Malaria, etc. on the records as they are is ridiculous.

The returns for 1916 have been carefully scrutinized and in order that some comparison may still be drawn to previous years the deaths have been divided not according to sex, but as to whether diagnosed by qualified or unqualified persons.

RETURN OF GENERAL CAUSES OF DEATH, TOWN DISTRICT, 1916.

Diseases.	Qualified.	Unqualified.	Total.
INFECTIVE DISEASES.			
Beri-Beri	1	...	1
Cerebro-spinal Meningitis ...	7	...	7
Dysentery	23	27	50
Enteric	1	...	1
Carried forward ...	32	27	59

RETURN OF GENERAL CAUSES OF DEATH. TOWN DISTRICT, 1916.—*continued.*

Diseases.	Qualified.	Unqualified.	Total.
Brought forward ...	32	27	59
INFECTIVE DISEASES.—*(continued)*			
Malaria	15	2	17
Malaria, chronic	2	...	2
Blackwater Fever	3	...	3
Pneumonia	58	4	62
Acute Rheumatism	1	...	1
Septicaemia	1	...	1
Syphilis	3	...	3
„ congenital	2	...	2
Small-pox	3	...	3
Tetanus	7	...	7
Tuberculosis	36	154	190
Undefined Fever	7	23	30
GENERAL DISEASES.			
Anæmia	1	93	94
Diabetes	6	1	7
Debility	24	165	189
LOCAL DISEASES.			
Diseases of the Nervous System.			
Sub-Section 1.			
Congestion of Brain ...	1	...	1
Meningitis	1	...	1
Sub-Section 2.			
Apoplexy	2	1	3
Epilepsy	...	3	3
Infantile Convulsions ...	6	36	42
Eclampsia	1	...	1
Paralysis	4	29	33
Sub-Section 3.			
Mental Diseases.—			
Dementia	2	...	2
Mania	1	...	1
Insanity	6	24	30
Diseases of the Circulatory System.			
Endocarditis	3	...	3
Valvular, aortic	1	1	2
Aneurism	1	...	1
Other Diseases	8	2	10
Diseases of the Respiratory System.			
Asthma	3	12	15
Carried forward ...	241	577	818

RETURN OF GENERAL CAUSES OF DEATH, TOWN DISTRICT, 1916.—*Continued.*

Diseases.	Qualified.	Unqualified	Total.
Brought forward ...	241	577	818
LOCAL DISEASES.—*(continued)*			
Diseases of the Respiratory System—(contd.)			
Bronchitis	9	83	92
Pleurisy	1	...	1
Other Diseases	1	...	1
Diseases of the Digestive System.			
Glossitis	1	...	1
Pharyngitis	1	...	1
Enteritis	3	1	4
Hernia	2	1	3
Diarrhœa	9	48	57
Hepatic Congestion ...	1	...	1
,, Cirrhosis	2	...	2
Jaundice	...	7	7
Peritonitis	1	...	1
Diseases of the Lymphatic System.			
Splenitis	1	...	1
Filarial Lymphangitis ...	2	...	2
Diseases of the Urinary System.			
Nephritis, acute	3	...	3
,, chronic	12	7	19
Cystitis	3	...	3
Vesical Calculus	1	...	1
Diseases of the Generative System.			
Male Organs.			
Orchitis	...	7	7
Female Organs.			
Endometritis	1	...	1
Delayed Labour	1	...	1
Puerperal Septicaemia ...	1	2	3
Concealed Hæmorrhage ...	...	1	1
Diseases of the Organs of Locomotion.			
Arthritis	1	...	1
Diseases of Connective Tissue.			
Abscess	2	...	2
Elephantiasis	2	2	4
Injuries—			
General	2	...	2
Local	13	1	14
Carried forward ...	317	737	1054

RETURN OF GENERAL CAUSES OF DEATH. TOWN DISTRICT, 1916.—*Continued.*

Diseases.	Qualified.	Unqualified.	Total.
Brought forward ...	317	737	1054
LOCAL DISEASES.—*(continued)*			
Diseases of Connective Tissue—(contd.)			
Tumours, Malignant ...	7	...	7
Poisons	2	...	2
Parasites:—			
Filariasis	1	...	1
Ankylostomiasis ...	16	...	16
Unclassified Causes and Undefined Diagnoses	5	23	28
Total ...	348	760	1108

The following call for some comment:—

INFECTIVE DISEASES.—*Bubonic Plague.* No deaths as compared to 2 in 1915, 33 in 1914, 0 in 1913.

Cerebro-spinal Meningitis.—7 deaths, none in previous records. Two of these cases occurred in town amongst Indian residents, aged respectively 14 and 11 years, both were recognized and isolated with their immediate contacts, and both died in isolation without further cases occurring. The other 5 deaths occurred amongst two separate batches of native porters invalided or time-expired from Mainland operations, fortunately these cases occurred during a period of quarantine and observation before contact with Zanzibar population had occurred.

Dysentery.—50 deaths as compared to 6 in 1915, 10 in 1914 and 11 in 1913. This increase in local dysentery is serious and referred to elsewhere in connection with flies and town incinerator.

Malaria.—19 deaths. *Undefined Fever,*—30 deaths. Whilst not reliable these 49 deaths are comparable to 92 for 1915, 145 in 1914, 159 in 1913.

Blackwater Fever.—3 deaths, 2 in 1915, none in 1914 or 1913.

Small-pox.—3 deaths, 1 in 1915, 3 in 1914, 5 in 1913.

Tetanus.—7 deaths as compared to 1 in 1915, 3 in 1914, 5 in 1913. The increase is accounted for by cases of gunshot wound from Mainland operations.

Tuberculosis.—190 deaths, 158 in 1915, 235 in 1914, 144 in 1913. It will be noticed that some 75% of these deaths were diagnosed by unqualified persons and a scrutiny of the individual Death Report sheets shows that the Inspector of the Dead signed practically all of them, probably based on a history of suggestive symptoms and emaciation of corpse, that practically all deaths occurred between the ages of 25 and 40 years after an illness lasting several months to years, and that the Inspector was sufficiently convinced of the accuracy of his diagnosis to go through a form of disinfection of sleeping room. That Phthisis Pulmonalis is widespread among bazaar Indians is undoubted and that from them the disease is spreading to Arabs, Comorians and Swahilis amongst whom cases are increasingly common. It is an interesting fact that tubercular disease of glands, bones and joints is almost unknown.

GENERAL DISEASES.—*Anæmia.* 94 deaths. 89 in 1915, 84 in 1914, 65 in 1913. Individual Death Report sheets reveal a prevailing age period of 30 to 45 years and many months of illness. Perhaps Ankylostomiasis is a cause.

Debility.—189 deaths. This diagnosis covers general and senile debility at advanced ages, and malnutrition, etc. in infancy.

LOCAL DISEASES.—*Infantile Convulsions.* 42 deaths. These cases probably cover malarial hyperpyrexia, gastro-enteritis, etc.

Paralysis.—33 deaths.

Insanity.—30 deaths. Mainly in old persons and detailed as insanity and debility.

Syphilis certainly causes the greater number of central nerve lesions.

Bronchitis.—92 deaths. Mainly at the extremes of age.

Diarrhœa.—57 deaths. 63 in 1915, 61 in 1914, 42 in 1913. The majority in elderly persons after illness of several months duration.

Jaundice.—7 deaths. All diagnosed by Inspector of Dead and revealing chronic illness of some form.

Local Injuries.—14 deaths, included are several cases of gunshot wound from Mainland operations.

Tumours, malignant.—7 deaths. All of Indian nationalities comprising 4 of breast, 2 of liver, 1 of throat.

Ankylostomiasis.—16 deaths. 11 in 1915, 18 in 1914, 2 in 1913. The number of deaths gives no evidence of the wide prevalence of this debilitating disease.

(*e*) Total number of deaths for the whole Island by Districts.

Districts	1916	1915	1914	1913	1912	1911	1910
Town District ...	1168	1008	1239	1022	1288	1374	1363
Mkokotoni District ...	881	1005	801	889	1116	1258	1029
Chwaka District ...	394	378	299	328	782	459	402
Mwera District ...	814	829	721	766	1071	740	740
Totals ...	3257	3220	3060	3000	4255	3830	3534

In the above table it should be remembered that in 1912 a limited epidemic of Cholera occurred in the out-districts.

SPECIAL DISEASES AND PREVENTIVE MEASURES.

Plague.—No case of plague occurred during the year and no infection was found in spleen smears of rats examined.

A total of 47,049 rats was collected at the various stations as compared to 49,095 in 1915.

Poisoning and trapping of rats must be constantly and methodically maintained, houses made as rat proof as possible, debris of ruinous walls and houses removed, drains improved, kept flushed and periodically Claytonized, food stuffs protected, and stringent measures maintained to prevent accumulations of exposed garbage.

Small-Pox.—It is satisfactory to report that no case of small-pox has occurred within the Protectorate for the last 3 years. Cases recorded under Infectious Diseases Hospital were all landed from passing ships.

It was found that vaccination, except of clove pickers travelling to Pemba for the harvest, had been seriously neglected since the outbreak of war owing to absence on active service of the principal vaccinator and the employment on other duties of those ordinarily following up monthly birth records by visits for the purpose of vaccination. This lapse will be difficult to rectify and leaves the younger population dangerously exposed: the temporary employment of an increased staff of vaccinators and methodical house-to-house visits in town with vaccination in out-district villages will probably be necessary.

Dysentery.—It has been recorded above that there were 50 deaths ascribed to Dysentery as compared to 6, 10 and 11 in the previous 3 years. An analysis of individual reports shows that of these 50 fatal cases 39 deaths occurred amongst Asiatic and African residents in May, June and first half of July alone, 21 of whom were Indians. A mortality of 39 may reasonably be interpreted as representing some 250 or 300 cases of dysentery, and an increasing local incidence of this disease has been remarked by practitioners in recent years. Many dysentery carriers must have arrived from the Mainland since the outbreak of war and it is impossible not to associate these cases with an annually increasing plague of flies in the months of May and June, during and following the rains, when they breed out in myriads from the accumulation near Darajani Bridge of town garbage with which, owing to its sodden condition, the Incinerator cannot cope. A study of the localities of the 39 deaths tends to bear out this supposition since 30 of these occurred in districts included in a circle of some 400 yards radius with the Incinerator and adjacent meat and fish markets as a centre, an area corresponding to the heaviest infestation with flies.

Leprosy.—The want of any real segregation of lepers, the difficulty of access to them in the three scattered inland settlements in Pemba, and the unnecessary total cost of their maintenance without any compensatory protection afforded to the general public is again urged. In a small island Protectorate such as this it is self-evident that the segregation of all lepers on one selected island is obviously the only rational scheme.

A few years ago Professor Simpson after a personal inspection strongly upheld the suggestion that Makongwe Island off the South coast of Pemba should be acquired and converted into a leper settlement for the Protectorate, and the further suggestion was made that possibly the lepers of the East Africa Protectorate might be segregated there also.

The following are the numbers of lepers recorded at the settlements in 1916:—

WALEZO LEPER ASYLUM, ZANZIBAR.

Particulars.	Males.	Females.	Total.
Remaining on 1st January, 1916	40	59	99
Admitted during 1916	16	9	25
Discharged	...	1	1
Deaths	8	8	16
Remaining 31st December, 1916	47	60	107

LEPER SETTLEMENTS, PEMBA.

Particulars.	Nduuni.	Pujini	Kengeja
Average Monthly Numbers	52	92	41
	Average Total ...	185	

MOSQUITO-BORNE DISEASES.

Filariasis.—Past investigation has shown that some 30 per cent of our natives harbour the micro-filaria and it is my own opinion as that of other medical officers that cases of elephantiasis and filarial lymphangitis have undoubtedly increased in recent years within the town precincts. A cause of recurrent invalidism filariasis does not figure prominently in Hospital or Public Health records.

A previous M. O. H. put it on record that the principal breeding places of our domestic varieties of mosquito were the "choo" pits (open privy cesspits) which exist in practically every Asiatic, Arab and African house and hut, and that the protective oiling of these was an impossibility: but the contents of these are semi-solid and, as far as Dr. Aders' investigations with fly traps have gone, are unsuitable for the breeding out of mosquitos.

Another fallacy reiterated in past annual reports and based on local findings was an apparent great preponderance of Stegomyia over

Culex in the town area: this has been disproved definitely by Dr. Aders' investigations of catches of adult mosquitos in houses which show a great preponderance of Culex. The reason for the previous error is not far to seek since throughout the densely overbuilt town some two or three cesspools exist in every house in the foul water of which the Culex breeds in myriads hidden from the visiting inspector. On the other hand Stegomyia larvæ abound and are patent to all in the various household receptacles for clean water, filled by paid water carriers from nearest standpipe or collected during downpours of rain.

It is believed that as regards Stegomyia education and organized weekly house-to-house district inspections will go far to reducing this mosquito, but the cesspool breeding Culex is a more difficult problem.

Cesspools.—Owing to the low lying level of the whole town site, the massed buildings over its entire area, and to want of available water no extensive water carriage system of drainage is possible. Hence, with the very few exceptions of European houses situated on the foreshore,every house in the town must dispose of its fluid waste from kitchen, pantry, bathroom, floorwashing, etc. by means of cesspools, and further such cesspools must often have pipe connections from upper floors.

Fortunately our porous soil of coral and sand permits of direct and comparatively rapid downward percolation and cesspools only become unsatisfactory when they receive rain water in excess of their rate of percolation, when the interstices in their loosely built coral rubble walls become blocked, or when they happen to be sunk in a patch of less permeable soil.

The process which occurs within these cesspools is undoubtedly closely similar to that in a septic tank and the fluid portion of the contents filters downwards until it mingles with the tidal salt water which forms our sub-soil water, thence escaping laterally into the surrounding sea at a level only exposed and to be observed at very low tide and marked by a strip of dark, discoloured and rather foul smelling sand at most points of the beach round the town site.

Cesspools and Mosquitos.—The preference of Culex for foul water as a breeding medium, and the proved preference it shows for cesspool water, creates a serious problem when the many hundreds of square yards of available cesspool surface through the town is considered. The oiling of thousands of cesspools is obviously impracticable and prohibitively costly and it remains to devise a means of preventing the entry of adult Culex mosquitoes into them and so reducing the available area of this particular medium.

The solution of this problem appears to lie in simple earthenware S or U intercepting traps with water seal for cesspools with floor or pipe connections, and in ordinary gulley traps for courtyard cesspools. The fluid forming the seal is never likely to remain for a week, or even in most cases for a day, without being flushed onwards, and even should it occasionally be kept standing beyond that period its surface is of a few square inches instead of the several square feet of surface of cesspool contents. Adult mosquitos cannot possibly pass the seal and should larvæ be washed through the trap and hatch out in the cesspool they could not emerge.

Such traps have been introduced experimentally into a few houses, including four in my own, and have proved eminently satisfactory.

It is strongly urged that similar traps should be procured and introduced into all the houses of a selected area of the town, a quarter being selected of houses varying in size and construction and occupied by as cosmopolitan a group of residents as possible.

Faulty down pipes, pipe connections, and designs in piping should be corrected at the same time and movable cesspool covers introduced wherever possible. It is presumed that no adult mosquito could make its way down an intermittently wet down-pipe exceeding some 9 feet in length, a point which will be submitted to experiment, so pipes exceeding that length, if without faulty joints and connections, would not require traps so far as mosquitos are concerned.

Other Breeding Places.—In addition to cesspools there still exist old quarry holes, big borrow pits and hollows at various places through the native quarter which regularly provide breeding areas after a few wet days and persist as ponds for some weeks after the rains. These not only maintain our town mosquitos but provide flight pools for the annual invasion of swamp mosquitos. Such must be eradicated by draining or filling.

Overflows from fixed standpipes afford further trickles and puddles of fresh water in which throughout the driest seasons of the year mosquitos find breeding places. Distance from the sea and creek precludes the possibility of concrete or other channels as drains for such overflows and it would appear that large trapped cesspools, as proposed by Dr. McHattie, to be pumped out at intervals if necessary, afford the best solution of this difficulty.

Rain water gutterings of poor material, faulty design, and fixed by ignorant labour are a further constant source of nuisance.

Heavy Vegetation.—Apart from breeding out places the annually multiplying areas of densely overgrown gardens and ornamental grounds afford increasing protection to adult mosquitos against sun and breeze. The cultivation of private gardens in recent years has added much to the beauty of the town and they afford patches of restful colour amongst our dazzling roads and white houses, but the rapidity and wealth of tropical growth have exceeded the estimate of the original horticulturists so that most so-called gardens are composed of big heavy foliaged trees and dense shrubberies obstructing what should be open airy spaces between dwelling houses.

It is evident that such harbouring places for mosquitos must be controlled, existing gardens must be submitted to intelligent consideration and judicious thinning, the laying out of future gardens must not be left entirely to the whim of the enthusiastic owner, and the town areas of gardens and ornamental grounds have now reached such an extent that the Director of Agriculture should be given a permanent staff of gardeners for such work alone.

The small plots of Arab gardens, compounds, and family grave yards with encircling 12 and 16 foot walls, mainly filled with a dense jungle growth, also afford shelter, shade and moisture for mosquitos. Such walls should be reduced to a maximum of 6 or 8 feet, or preferably 4 feet with superimposed railings.

MALARIA.—No present records are any guide to the prevalence of malaria through the Protectorate. The great majority of cases in towns either go untreated or are treated by private practitioners, hakims, and native "waganga" (doctors), while those in out-districts must rely on the "mganga" solely.

Our register for that small part of the population which seeks treatment at Government Native Hospitals and Dispensaries shows that of all cases of illness treated 20·5 per cent of in-patients and 9 per cent of out-patients are diagnosed as malaria and undefined fever. But without being able to quote actual statistics the following general facts are known to all doctors with experience of work amongst our cosmopolitan population:—

(*a*) Indian residents are more predisposed than Arabs, Arabs more than Africans.

(*b*) Malarial attacks in Africans are more often relapses of a latent infection due to changes of weather and chill, occurring irregularly at any season, and in town with the onset of the rains before the annual invasion by anophelines has begun.

(*c*) Indian residents in the town proper of all ages seldom show splenic enlargement, similar residents in Pemba townships, from all plantation districts, and from the Mainland coast almost invariably have marked chronic enlargement. Amongst town residents enlarged spleens become increasingly more frequent as the locality af their dwellings approaches nearer to the outskirts of the native quarter of Ngambo towards our permanent anopheline breeding grounds.

(*d*) Splenic enlargement amongst Arabs accords with the above experience amongst Indians, practically universal at all ages in plantation districts.

(*e*) Such enlargement is uncommon in local African adults and not so common amongst their children as in those of Indians and Arabs living in malarious areas

(*f*) The "Fever season" amongst town residents regularly commences towards the end of May, is at its height through

June and early July, and wanes to about the middle of August; a varying exacerbation occurs at the close of the year perhaps lasting through January to February. These periods correspond to the two annual invasions of the town by anophelines so soon as flight pools of standing rain water afford them the means of entry to the town and a suitable medium for their multiplication. The average onset of the rains is in the middle of April, the rainfall continues decreasingly through May and into June, after which, dependent upon showers, degree of water logging of soil, drying winds, sunshine, etc. swampy areas, pools and ponds of water remain for varying periods of weeks.

The same conditions recur on a smaller scale with the small rains beginning about the middle or close of October.

Investigations by Dr. Aders and the findings of mosquito brigade reveal the following general facts:—

(*a*) The common malaria carrier is the Anopheles Costalis.

(*b*) Anopheline larvæ can be found perennially in certain swamp areas, mud wells, ditches, etc. beyond the outer fringes of the native quarter notably Kiungani, Sebuleni and Gulioni districts which are hence our nearest permanent breeding places.

(*c*) With the onset of the rains these waters increase and potential breeding places in neighbouring low-lying areas hold water, and anopheline larvæ are found in greater numbers and over wider areas with increasing ease.

(*d*) Certain known hollows within the town area (already referred to in connection with town-breeding mosquitos) hold water, and various low-lying areas in and around the town, off which pools at first quickly dry and disappear, become water logged, retain standing water, and in due course are infested with larvæ.

(*e*) A study of a "spot" map of anopheline larvæ finds through the year reveals two definite lines of advance into the town. From Kiungani swamp, through low-lying Ziwani ground and outlet of surface drain, in Indian gardens and Cooper's Institute, along golf links, in overflow from cattle trough, drain outlet near Native Hospital, Victoria Gardens, and so into Shangani District. The second route from Punjabai Club stream and Gulioni swamp, under railway embankment and alongside Lady Janbai Road, deep hollow below Simba Mosque, at Kwahema near wood yard, Kamasini pit, Mchangani, and so into Darajani District. Whether the area between these routes, which is the greater part of the native quarter of Ngambo, is as negative as the map shows will be proved by experiment.

(*f*) After the above advance of anophelines all quarters of the town are infested for a varying period until, as flight pools dry up and adult insects die off, their larvæ can again only be found beyond the outskirts of the town where they breed permanently.

Microscopical examinations of local malarial blood films reveal the following general facts:—

(*a*) The Plasmodium falciparum of subtertian malaria is almost universal, quartan parasites are extremely rare, and benign tertian practically never seen.

(*b*) Parasites are very scanty as a rule, seldom seen of more than one third development, and crescents remarkably rare.

(*c*) Prolonged search of several films taken at one time from a patient undoubtedly suffering from malarial pyrexia and before the exhibition of quinine frequently results in negative findings both as regards parasites and mono-nuclear increase.

Preventive Measures.—With regard to the town of Zanzibar measures must be aimed at the mosquito carrier and based upon our present more exact knowledge of its permanent and temporary breeding haunts, its preference for certain waters, its habits, and its powers of flight and endurance. In my opinion the following scheme is practical, essential and will be followed by most satisfactory results:—

I. The eradication of all the nearer permanent breeding places so that our constant anopheline output takes place further distant from the town:—

(*a*) Extension of the present partial drainage of Kiungani-Migombani swamp area, the drainage of Gulioni area, and necessary grading and filling of Ziwani and Sebuleni areas already drained.

(*b*) The careful consideration of domestic and agricultural needs as regards water supply for the inhabitants of those areas and the provision and maintenance of properly constructed wells, with raised masonry walls and covers, to replace existing surface wells of mud hole type. The provision of standpipes of town water supply if possible and if overflows can with certainty be controlled.

(*c*) The strict prohibition of the digging of further surface wells in these areas after sufficient water supply has been provided for cottagers and agriculturists.

(*d*) Strict control of lateral drains in drained areas to prevent agriculturists from damming water back on to their vegetable grounds.

II. Means to render the flight of mosquitos from plantation haunts to town outskirts as difficult as possible:—

(*a*) Felling of all unnecessary and heavy foliaged trees between swamps and town, since they afford shade, moisture and cover from winds.

(*b*) Compulsory maintenance of all gardens and plantations in this area cleared of scrub, undergrowth, weeds, etc. Special efforts should be made before the onset of the rains in April.

III. Means to prevent the continuance and increase in number of such adult anophelines as manage to cross the above neutral zone:—

(*a*) Draining, filling, oil-spraying, poisoning, or stocking with "millions" fish the known temporary flight pools.

(*b*) All anti-mosquito measures aimed at our town-breeding varieties of mosquitos.

I am convinced that the above measures for Zanzibar Town, and work on similar lines for the townships of Pemba and out-district stations in both islands, will be followed by an appreciable diminution in mosquitos and malaria cases, that anti-mosquito work must mainly be accomplished within the first three months of each year and not when mosquitos have already made themselves obvious to all with the rains, and that this Administration has not yet realized its responsibility for the wide prevalence of what is very largely a preventable disease.

Until such work is undertaken and maintained with constant zeal every township and station throughout Pemba and every outstation in Zanzibar Island must be condemned as constantly malarious, and the town of Zanzibar classed in the same unhealthy category during the seasons of standing water.

Prophylactic Quinine.—The taking of prophylactic quinine is still a perennial necessity throughout the whole Protectorate outside of Zanzibar town, and for Town residents at certain seasons, although its regular consumption is largely neglected.

To the general scattered plantation population of Indians, Arabs, and Africans quinine in divided doses should be purchasable at cost price from the masheha (headmen) of villages and districts.

TOWN SANITATION.

The routine inspections of premises, shops, dairies, stables, drains, etc., for structural faults, nuisances, etc., have been carried out and notices served when necessary.

As personal inspection of insanitary conditions with a view to ascertaining the best means of correcting them appeared to have been entrusted overmuch to subordinate staff regular weekly afternoon rounds of district inspection were made with the Sanitary Inspector, the Sub-Inspector of the particular area, and, in so far as their spheres of speciality were concerned, with Economic Biologist and Mosquito Brigade Inspector. Much useful knowledge was obtained and discussion and expression of opinions encouraged: the visits were followed up by notices or letters to householders and departments concerned on nuisances and irregularities requiring correction. Factors requiring consideration in a comprehensive Town Planning Scheme were constantly under discussion.

Town Bazaars.—The insanitary condition of the great majority of town houses and their hopeless lack of light and ventilation owing to narrowness of dividing lanes form rather a stupendous problem. Little can be achieved by attacking individual houses, although of these it is evident that hotels, Indian lodging houses, Government and Wakf-owned houses must receive first attention, but gradually over a term of years money must annually be set aside for the acquisition of whole blocks of buildings to be razed and rebuilt on approved lines. With a view to permitting freer perflation of breeze into the bazaars it would seem well to commence operations with a block or blocks of buildings on the outskirts of the town and towards the N. E. monsoon. With the present overcrowding of all houses no such work could be undertaken until a new block of buildings was erected into which evicted tenants could be moved.

Town Lanes.—The only roadway which can be termed a street is that which runs almost completely round the margin of the triangular town site, the mass of houses within this triangle is intersected by narrow irregular lanes of no alignment. These are further narrowed and obstructed by projecting masonry "barazas" and by overhanging iron roofing erected to protect goods exposed for sale on such "barazas". The surfaces of these lanes are badly broken and in disrepair which hinders sweeping and cleaning, their condition mainly due to erosion by clumsy hand carts loaded with heavy goods. It is the present custom for merchants to utilize the back rooms of the ground floor of their bazaar dwelling houses as godowns for their goods, hence the heavy traffic of hand carts. It is offered as a suggestion that in future the storage of heavy bulky goods in these houses should be forbidden and that an area alongside the existing railway, as in Malindi or Kokoni, should be set apart on which to erect single-storey godowns. Branch lines from the railway into godowns and into Custom House, loop lines in that length of rail along the sea front, and the provision of hand trucks of the same gauge would take most of the heavy traffic off these lanes. Such a system would result in additional room space through the Bazaars and would allow of the demolition of semi-ruinous houses in favourite business quarters.

European Quarter.—No effort has been made in the past to define or create an European quarter and with very few exceptions residents occupy houses closely surrounded by those of Asiatics and Arabs, the latter with large Swahili households, and those whose houses front on to the sea are necessarily at a low level and obstructed on the landward side by serried rows of houses standing at a higher ground level. A time has come in the history of nearly all old Eastern towns, built and continually added to without any regard to the tenets of hygiene, that Europeans, realizing the unhealthiness of obstructed houses thronged round by native dwellings, have emigrated to open districts beyond the town's confines and there built themselves situable well ventilated houses in country surroundings. In the case of Zanzibar the ridge alongside the golf links, an ideal site for detached houses of bungalow type with surrounding gardens, was irrevocably lost many years ago to an Indian community as a burial ground, and high ground further on in Kiungani direction with cliffs and open sea to the West, is still a malarious district owing to swamp, heavy plantations and tropical growth on the landward side.

The comparative advantages of different areas of the town proper have consequently been carefully considered and that area of Shangani between Bhagani and Victoria Gardens extending from the Main Street back towards Vuga was selected as evidently the most suitable for an European Quarter. The area stands high, free exposure to breeze in both monsoons can be secured, the existing European houses on all sides would be greatly improved, the small houses and huts now occupying the area could be acquired at comparatively small cost, several open spaces are already available from recent clearing away of huts, and the row of two-storey Indian and Arab houses lining the the Main Street, which it is proposed should be demolished to encourage entry of breeze from the sea and the West, are mainly motor and carpenters' shops, insanitary, and a blot in an otherwise mainly residential area. The scheme has been carefully considered with the Acting Chief Secretary and Director of Public Works with a view to applying for a sum to be voted annually until it is accomplished.

Conditions existing in Pemba's townships must similarly be considered.

Town Water Supply.—The scheme of the late Director of Public Works for supplementing our supply having been a total and costly failure it is to be hoped that the augmentation of our Chem Chem supply from available water at Chukwani as proposed by the present Director will be hurried on as soon as the necessary pumping plant can be imported. This Chukwani source of water seems ample and permanent, it remains to have it carefully analysed over a period of weeks and under varying conditions for organic pollution and contamination by sea water. The pumping experiments already made, the general lie of the surrounding country, and comparison to similar accumulations of subterranean water in other areas of the islands, give every reason to hope that the water will be satisfactory. The need for more water is obvious.

Many old Arab wells throughout town and native quarter in close juxtaposition to cesspools have already been filled in, but the pipe borne water supply at present being insufficient it has been impossible to replace these by standpipes and considerable hardship on house owners and tenants has arisen owing to the distance water has to be carried by hand for the cleaning of courtyards, latrines, kitchens, etc. The not infrequent extensive fires amongst thatch roofed huts in the native quarter periodically arouse interest in the water question. The dustiness of our coral built roads and streets, with risk of dust borne diseases, demands frequent watering, but of recent years this practice has been stopped. The fact that drains are only channels of filth without water to flush them has been overlooked in the past when "drains" were laid in the town area and connections made to large bazaar houses, such as Indian lodging-houses, etc. The accumulations in these and connecting down pipes, and their infestation with rats, after months of dry weather can easily be imagined. Cesspools properly designed are infinitely preferable and drains should only be used for storm water or where a standpipe can easily and frequently be connected to the highest level of a well built house drain. The proposed additional water supply from Chukwani with its 30 foot head will, with the laying of a drain down the Main Street to the sea, enable water-carriage system of drainage with waterclosets and fixed baths to be introduced into many European houses in Shangani, an advantage which was not overlooked in the selection of the area to be opened up as a European quarter.

Town Refuse—Disposal.—The efficient and economical disposal of Town refuse without causing nuisance to one's own or neighbouring towns' residents is a constant problem, but for Zanzibar town with sea on two sides of the triangular town site, with no other town in the whole island, with miles of agricultural country behind it, and with some seven miles of narrow gauge railway running out from its midst into that country, the difficulties of disposal are very much minimized. Yet in spite of these advantages a large Incinerator was erected a few years ago practically in the middle of the town, on the creek edge between town proper and native quarter.

To the actual working of this Incinerator the sole objection is its failure to cope with rain sodden refuse for several weeks of every year. To its site objections are numerous and increasing. It is situated within some 100 yards of the public meat, fish and vegetable markets over which its smoke and dust pour throughout the N. E. Monsoon; flies haunt the freshly arriving carts of refuse constantly and breed out in myriads when non-incinerated wet garbage is spread on the bank of the incinerator's debris: this evergrowing bank of burnt residue (its accumulation at this spot can never have been intended or foreseen) obstructs the creek further every year, is the cause of silting up of the creek bed and a foul accumulation higher up of festering stable sewage which never dries, and it has approached to within some 30 yards of the public markets on the opposite bank.

Existing conditions are actually worse than in byegone days when the cart collections of refuse were tipped into the creek water further towards the sea outlet. It was and is considered that the tidal flow of creek water should be encouraged by every possible means, by deepening its bed, alignment of bank even by masonry walls if necessary, since its flush of salt water must have a cleansing effect: instead of which the bed has been allowed to silt up, the East bank is more irregular then ever before, and the stench of deposited filth at low tide is overpowering. Ranged along the West bank of this unwholesome area are our markets and here our food is purchased.

If our town refuse is to be disposed of by incineration then the incinerator must be dismantled and re-built outside the town in connection with our railway; an excellent site traversed by the railway exists beyond the ruins of Mtoni Palace. A central refuse collecting station with railway siding, roofed over, and with platforms to allow of the tipping of hand carts directly into waiting trucks, must be erected at Malindi, just North of the new bridge, and the necessary trucks with hinged covers provided. During the rains and in wet weather the refuse once carried out beyond the town could be buried, or even exposed until sufficiently dried to be incinerated.

The number of handcart loads of town refuse taken to the incinerator during 1916 was 55,590 (as compared to 51,559 for the previous year) an average of some 153 loads per diem. On this figure the number of railway trucks and rail journeys per diem must be calculated.

With the removal of the incinerator its present residue must be removed and utilized for the straightening of creek banks and the filling of water-containing hollows.

If the town refuse is of greater value for agricultural purposes then a similar collecting siding and a branch line with tipping trucks led out into any suitable valley should be considered.

Disposal into the sea, owing to shallowness of water round Malindi spit, would involve the erection of a pier, the purchase of special lighters, and a careful study of tides, winds and currents.

Collection.—The condition of Bazaar lanes and back alleys is still unsatisfactory mainly owing to the dirty habits of the residents. Not troubling about cleanliness within their own houses they consider that their duty ends with the flinging out of such refuse as they cannot wash into house cesspools.

Small wooden boxes with lids are provided but these are too few in number and easily overturned by pariah dogs, cats, etc. and being of porous material become very foul. In addition large iron dustbins with hinged lids are placed at fixed sites throughout the town. These rapidly erode, lids are left open, hinges become broken and they never prevent the entry of flies.

The provision of metal boxes for householders would be too costly but a greater number of wooden boxes should be provided so that, with an ample number distributed, those in excess can be cleansed and painted with tar.

Similarly the metal dustbins must be increased in number with a sufficient excess for repairs: they must be made with a heavier, self-closing flanged lid to prevent the entry of flies, and stronger hinges. Dr. McHattie, M. O. H., has designed a suitable pattern.

Markets.—The meat, fish and vegetable markets in town, townships and out-stations are of sensible simple design, but in practically all cases their necessary daily flushing and cleansing is rendered impossible by chests, boxes, and cupboards in which vendors are permitted to store their goods overnight. In addition certain markets permit tea and coffee sellers to conduct their business with all its consequent charcoal soot, ash, and cupboards of crockery. These markets and their surface drainage system must be kept in better repair, must be completely emptied of all goods when marketing hours are over, tea and coffee sellers should not be permitted to use them, and if, as is probable, persons bringing goods from afar must store their wares securely over-night a separate godown must be built in connection with each market, its space to be leased out to such persons.

Town Cowsheds.—The insanitary conditions of these, the objections to their close contiguity to crowded dwelling houses, the need for a pure milk supply, and the necessity for housing and stall-feeding Indian milch cows within the town area owing to East Coast Fever through all our pasture lands have all been pointed out in previous annual reports. Existing cowsheds have been studied more critically during the year and suitable sites on which to erect model cowsheds have been noted. It is suggested that Government should build one or two cowsheds of simple approved design and with necessary outbuildings, water supply, etc. It would then be possible compulsorily to evict private herds from insanitary cowsheds and charge rental until the owners rebuilt their sheds or built others of approved type and site. It is further believed that owners of cows would be willing to rent Government built sheds and that the returns would justify the expenditure.

Some 450 to 500 milch cows, many of them valuable Indian beasts, are housed within the town area and the question of their sanitary housing is pressing. I am opposed to the housing of all cows on a single site and to the housing of too many cows in a single shed for fear of epidemic or contagious disease, and I consider that sheds to accommodate 75 with their calves should not be exceeded. Suitable sites for sheds of such dimensions have been noted near Government Stables, in Mkunazini, at Malindi-Kokoni, and in Bhagani, while there are other sites adapted for smaller herds.

Offensive Trades.—The industry of hide curing has greatly diminished within recent years but should not be permitted within the town area. Pottery baking is mainly carried on in the Malindi-Kokoni area and creates nuisance owing to rats harbouring in the accumulations of inflammable refuse and from the smell of the burning of such refuse with the pottery buried and baking in it. Lime burning is carried on in the same area and causes some nuisance to neighbours owing to pungent smoke fumes. The breaking of nuts for copra, in the absence of sound floors and drainage, results in foul smelling fermenting accumulations of fluid, objectionable though possibly not injurious.

PREVENTION OF INFECTIOUS DISEASES.

Port Sanitary Service returns for 1916.

Months	No. of steamers	Particulars of steamers					No. of dhows	Particulars of dhows					Total No. of passengers
		Nationality		Pratique				Nationality		Pratique			
		British	Foreign	Full	Restricted	Zanzibar Passengers landed direct		British	Foreign	Full	Restricted	Zanzibar Passengers landed direct	
January ...	9	8	1	8	1	397	16	4	12	16	...	3	400
February ...	8	7	1	8	...	248	44	7	37	44	...	127	375
March ...	14	13	1	14	...	372	44	7	37	44	...	327	699
April ...	15	13	2	14	1	324	4	4	...	4	...	...	324
May ...	13	10	3	13	...	326	...	...	...	...	...	...	326
June ...	9	8	1	9	...	153	...	...	...	...	...	...	153
July ...	7	6	1	7	...	299	...	...	...	...	...	...	299
August ...	12	8	4	11	1	389	...	...	...	...	...	...	389
September ...	13	11	2	13	...	442	7	7	...	7	...	61	503
October ...	21	17	4	21	...	932	13	13	...	13	...	68	1000
November ...	22	20	2	22	...	1596	28	4	24	28	...	183	1779
December ...	34	31	3	33	1	912	125	6	119	125	...	359	1271
Total ...	177	152	25	173	4	6,390	281	52	229	281	...	1,128	7,518
Comparative Figures for 1915 ...	199	170	29	195	4	4,706	64	8	56	64	...	261	4,977

QUARANTINE STATION ON PRISON ISLAND.

Owing to extensive small-pox in Indian ports and various epidemics of disease in East African coast towns the work on this station was abnormal, long periods of segregation of unfit persons demanding hospital treatment in addition to quarantine accommodation. As in previous years the station had to provide for passengers destined for East Africa and Uganda Protectorates in addition to those for Zanzibar and Southern ports.

Origin	Infected Port	Disease	Nos. in Quarantine	Date
S. S. "Dilwara" ...	Bombay	Small-pox	681	29th January
S. S. "Palamcota" ...	do	do	107	15th February
S. S. "Guildford Castle" ...	do	do	163	5th May
S. S. "Dilwara" ...	do	do	613	25th May
S. S. "Karoa" ...	do	do	174	24th August
H. M. T. "Barjora" ...	Mainland	Cerebro-spinal Fever, etc.	328	7th October
H. M. S. "Trent" ...	do	do do	130	26th October
		Total ...	2,196	

Of these 2196 persons in quarantine there were 185 admissions to the Quarantine Station Hospital with 32 deaths:—

Disease		Cases	Deaths
Pneumonia	...	96	25
Cerebro-spinal Meningitis	...	3	3
Dysentery	...	9	2
Diarrhœa	...	32	1
Ankylostomiasis	...	1	1
Other Diseases	...	44	...
Total	...	185	32

Of these 128 cases and 28 fatalities occurred amongst a batch of 328 time-expired or invalided African porters destined for Mombasa and landed by H. M. T. "Barjora".

INFECTIOUS DISEASES HOSPITAL, GULIONI.

The following table shows the admissions during the year 1916.

Diseases	Remaining from 1915	Admitted 1916	Total	Deaths	Discharged	Remaining 31st Dec. 1916	Remarks.
Cerebro-spinal Meningitis	...	4	4	3	1	...	
Chicken-pox ...	...	12	12	...	12	...	
Measles ...	...	4	4	...	4	...	
Small-pox ...	...	18	18	3	15	...	
Under Observation:—							
Ankylostomiasis ...	...	1	1	1	...	...	
Diarrhœa ...	...	2	2	...	2	...	
Leprosy ...	...	1	1	...	1	...	To Leper settlement, Walezo.
Phthisis ...	1	1	2	...	2	...	To Government Hospital.
Contacts ...	...	29	29	...	29	...	
Sick Paupers ...	...	5	5	...	5	...	Discharged to Poor House.
Total ...	1	84	85	11	74	...	

Of the 4 cases of Cerebro-spinal fever one came from our Indian bazaars, the others amongst African porters from German East Africa operations.

The cases of Small-pox were from S. S. "Dilwara" 15, S. S. "Glenart Castle" 1, S. S. "Guildford Castle" 1, S. S. "Karoa" 1, The two cases of Tetanus were both German African porters.

SICK POOR HOUSE, WALEZO.

Particulars.	Males.	Females.	Total.
Remaining from 1915	23	14	37
Admitted 1916	51	29	80
Discharged 1916	16	2	18
Deaths 1916	24	20	44
Remaining 31st December, 1916	34	21	55

BACTERIOLOGICAL AND CHEMICAL DEPARTMENT.

Owing to depletions in and additional extra duties thrown on the staff no chemical analytical work was undertaken and bacteriological work was limited to microscopical and other purely diagnostic purposes.

Blood films	443	Nasal Scrapings	28
Sputa	119	Media and Stains	36
Faeces	432	Culture Inoculations	78
Urines	47	Police case, etc. Analyses	17
Smears	86		
		Total	1,286

FINANCIAL.

The sanctioned Public Health Department Budget for the year 1916 was Rs. 192,410 of which Rs. 169,040-86 cts. were spent leaving a balance of Rs. 23,369-14 cts.

EXPENDITURE.

Particulars of votes.	Estimate		Actual Expenditure.				
	Rs.	£	Rs.	cts.	£	s.	d.
Personal Emoluments,	127,760	8,517	116,362	51	7,757	10	0
Under this heading are included the salaries and duty allowances granted, of the Medical Officers of Health, Veterinary Zoologist, Sub-Assistant Surgeons, Sanitary Inspectors, Inoculator, Vaccinators, Rat Trappers and Dissector, Mosquito Inspectors, Disinfecting Engineer, Clerks, Caretakers, Scavengers, etc.							
Other Charges,	64,650	4,311	52,678	35	3,511	17	10
Under this heading are included the passages and travelling allowances, Suppression of Infectious Diseases, Quarantine Station, Upkeep of Laboratory, Museum, Cattle Quarantine Station, Slaughter House, Markets, Dhobi Station, Mwembe-Ladu Grave-yard, Leper Asylums, Poor House, Motor Boat, Motor Cycle, Purchase of Disinfectants, Drugs and Dressings, Vaccines, Serums, Sanitary Appliances, Furniture, Uniforms, etc.							

H. CURWEN,
Principal Medical Officer.

VETERINARY DIVISION, REPORT FOR 1916.

DISEASES OF STOCK.

The usual number of animals infected with Trypanosomiasis and East Coast Fever have been detected as in previous years.

A few cases of Rinderpest were discovered among a herd of cattle imported from British East Africa during the last two or three days of the year.

Trypanosomiasis.—As far as possible blood examinations have been made of all local stock brought to the Health Office for inspection or other reasons. In several instances it was found that apparently healthy cattle harboured trypanosomes in their blood.

The type of trypanosome was in all cases small, stumpy with no free flagellum, biological reactions showed guinea-gigs resistant, dogs highly susceptible; on this evidence our local trypanosome has been included in the T. pecorum group.

The majority of infected animals were draught oxen going to various out-districts. In former years a few cases of Trypanosomiasis have occurred from time to time in the Government Stables, always in those animals sent out to bring in forage. I am of opinion that T. pecorum is in all probability generally carried by Tabanidae and not by Stomoxydae. As mentioned in former reports Glossinae do not occur. As reported last year one heavily infected ox remained in the stables for some months, no other animals contracted the disease in spite of the presence of enormous numbers of Stomoxydae.

On one occasion only has a Tabanus been taken in the stables.

It is hoped that next year the geographical distribution of Trypanosomiasis will be studied in those out-districts where Tabanidae are abundant.

As mentioned in my report for 1915 loss among stock from this disease need cause no alarm for the future. Several animals have recovered after a long period of sickness.

East Coast Fever.—Seven milch cows and five calves died of this disease, in all instances diagnosis was based on the finding of Koch's Blue Bodies in spleen smears. In the majority of cases infarcts were not observed either in the liver or kidneys.

In 23 cattle imported from British East Africa Koch's Blue Bodies were found in spleen smears, the animals in question came from Lamu and Kismayu. These animals contracted the disease on our local pastures after leaving the quarantine park.

Tuberculosis.—One ox imported for slaughter from the mainland showed typical tubercular lesions of both lungs.

No case of tubercular disease was detected in town cows after death, a somewhat interesting fact considering the insanitary conditions and lack of air space in most of the town sheds.

120 milch cows were imported. All were tested with Tuberculin in quarantine, 13 showed typical reactions and were refused entry to the town cow sheds by order of the P. M. O.

Rinderpest.—Six deaths occurred among a batch of cattle imported from British East Africa. The post-mortem lesions were typical of the disease. One local ox was inoculated with 5cc of blood from a typical case counterbalanced by 100cc of Rinderpest serum (Nairobi stock). A typical reaction followed with recovery. This animal was left in contact with all subsequent cases and up to date June 1st, 1917 is well.

Red Water or Texas Fever.—Two cases were discovered in one of the town cow-sheds, one ended fatally.

Echinococcosis.—The cysticercus stage of this cestode has been found on many occasions both in the liver and lungs of cattle.

No case is on record from imported cattle or local oxen. On the other hand post-mortem examination of a number of slaughtered barren milch cows from town sheds showed many to be infected. Some pariah dogs have been examined for Taenia echinococcus, none were found, owing to their small size they may have escaped detection.

Strongylosis.—Haemonchus contortus is a common parasite in the abomasum and small intestine of local goats and cattle.

No case of severe infection has been brought to notice, I do not think that this parasite is responsible for any great losses.

Oesophagostomiasis.—"Pimply Gut" is very common in local goats. The large bowel and especially the caecum is liable to infection. The lesions are due to Oesophagostomum columbianum.

Taeniosis.—Various species of Taenidae have been found in local stock. The following have been identified:—

Cysticercus tenuicollis. Very common in local goats, the bladder is generally attached to the liver.

Adults of Monezia sp. are frequently met with both in local and imported goats.

Diseases among Poultry.—During the year there was an outbreak of Chicken Cholera in one poultry run resulting in the death of many fowls and ducks. These were removed to the Quarantine Station the disease did not spread.

Contagious Epithelioma has been noticed from time to time in fowls, guinea-fowls and turkeys, never in ducks. In some cases the disease runs a long chronic course with eventual recovery, among young birds of European parentage the malady is extremely fatal.

The disease seems to be related to Avian Diptheria (Roup), as these conditions often appear together.

VETERINARY EXAMINATIONS UNDERTAKEN IN BIOLOGICAL LABORATORY.

Number of Blood Films examined = 539.
Number of Autopsies made = 131.

The results of these examinations were as follows:—

Cattle, Cows and Calves.

Trypanosomiasis.	5.	(Trypanosoma pecorum)
East Coast Fever.	38.	(Babesia parvum)
Microfilaria.	1.	(In an imported ox from Kismayu)
Texas Fever.	1.	(In Bombay Cow ex town dairy)
Echinococcosis.	7.	(Cysticerci in liver and lung, all from milch cows)
Tuberculosis.	1.	(Lung from an imported ox)
Negative.	325.	

Horses, Mules and Donkeys.

Horse Sickness.	3.	
Trypanosomiasis.	4.	(all in donkeys, T. pecorum)
Negatives.	53.	

Camels.

Negative.	18.

DEATHS AMONGST STOCK.

Nearly all the deaths among draught oxen were due as in former years to various respiratory diseases, the majority occurring during the months of April and May the wettest season of the year.

Most of the deaths among imported goats and sheep were due to pleuro-pneumonia.

In the majority of cases post-mortem examinations were made; but the absence of any facilities rendered thorough examinations impossible as no convenient building or site existed.

In 1917 a small post-mortem room is to be built in close proximity to the town destructor.

Table No. 1.

Death Report 1916.

	Deaths in 1915.	Deaths in 1916.
Milch cows ex dairies...	25	29
Calves ex dairies ...	7	20
Cart Bullocks ...	27	33
Horses ...	5	5
Goats and Sheep ...	42	57
Donkeys ...	13	24
Mules ...	1	4
Buffaloes ...	1	2
Camels ...	...	1
Total ...	121	175

PIGADURI QUARANTINE PARK.

Animals arriving from foreign ports have been quarantined at Pigaduri for varying periods.

Within the last few days of the year a few cases of Rinderpest were detected among quarantined cattle and the whole herd was slaughtered in quarantine. Hides were sun dried for one week in the quarantine park before removal, hoofs and head skins burnt. I believe that if this procedure is strictly adhered to in the future there need be little fear of disease being imported into the island.

Table No. 2.

Number of animals Quarantined at Pigaduri.

	1915.	1916.
Oxen ...	1855	2199
Cows ...	9	125
Calves ...	4	88
Goats and Sheep ...	8801	9389
Camels ...	7	20
Donkeys ...	4	15
Horses ...	0	2
Mules ...	0	5
Total ...	10,680	11,843

IMPORTATION OF LIVE STOCK.

The marked increase in the number of animals imported during the year as shown in Table No. 3 was due chiefly to the needs of the Navy. Of 120 milch cows imported direct from Bombay 107 were admitted to the town cow-sheds after passing the Tuberculin test, 13 showed typical reactions and were refused admission.

Table No. 3.

	Animals imported 1915.	Animals imported 1916.
Oxen ...	1855	2199
Cows ...	9	125
Calves ...	4	88
Goats and Sheep ...	8801	9389
Camels ...	7	20
Donkeys ...	4	15
Horses ...	0	2
Mules ...	0	5
Total ...	10,680	11,843

ANIMALS EXPORTED DURING 1916.

Table No. 4 gives the number of animals exported compared with the previous year.

The majority were exported to Pemba, a few to the Mainland.

TABLE No. 4.

	Animals exported in 1915.	Animals exported in 1916.
Oxen ...	38	54
Cows ...	77	179
Calves ...	29	46
Goat and Sheep ...	429	279
Donkeys ...	41	16
Horses ...	2	0
Total ...	616	574

DAIRIES AND COWSHEDS.

Inspection of these are made from time to time. Their condition is extremely unsatisfactory, and until properly equipped cow-sheds under direct supervision of the M. O. H. are built, no improvement can be hoped for.

VETERINARY HOSPITAL.

The total number of cases treated was as follows:—

Donkeys, 67 sent for treatment, 22 after prosecution.

Horses, 3 sent for treatment, one after prosecution.

Mr. Hewett as in 1915 very kindly undertook the treatment of all animals sent to the Government stables.

GOVERNMENT ABATTOIR.

All meat has been examined before being passed to the market for sale.

Additional work has been thrown on the staff of the Abattoir owing to the large number of His Majesty's Ships and Transports requiring meat.

Normally the Abattoir is open from 5-30 a.m. to 7-30 a.m. and from 3-30 p.m. to 5-30 p.m. A special concession has been made for the Navy in allowing them to make use of the Abattoir at any time during the day or night.

The proposal made in 1915 that meat should be divided into two classes has not been brought into force owing to the shortage of meat and the difficulty of supplying the needs of the Navy.

The following improvements and additions to the building are contemplated:—

(1). All walls to be dressed to a height of 6 ft. with impervious paint.

(2). A special room with the necessary appliances to be erected for tripe cleansing.

(3). A large fly-proof receptacle to be provided for the storage of meat.

A large number of goat and sheep carcasses were partially rejected, owing to the fact that among those imported a large number suffered from Pleuro-Pneumonia.

Fees collected during the year for the use of the Government Abattoir amounted to Rs. 5368, an increase of Rs. 899 over receipts for 1915.

Some years ago permission was granted to various Indian communities that on special occasions and for religious festivals animals might be slaughtered in their respective Jamats. The M. O. H. has inspected these private slaughter-houses and concurs with me that they are in a most insanitary condition and a menace to the health of the town. Representations have been made that these indulgences should be withdrawn, and that all cattle should be slaughtered in the Government Abattoir.

Number of animals examined and Slaughtered.

TABLE No. 5.

Animals slaughtered in Government Abattoir.			Partially condemned.	
	1915.	1916.	1915.	1916.
Oxen	1,783	2,170	227	208
Cows ...	31	40	17	10
Calves ...	31	24	3	0
Goats ...	9,797	12,124	2,120	2,003
Sheep ...	891	402	369	71
Camels ...	10	17	1	5
Total ...	12,543	14,777	2,737	2,297

W. M. ADERS.
Economic Biologist.

ECONOMIC BIOLOGY.

ENTOMOLOGY IN RELATION TO PUBLIC HEALTH AND PREVENTIVE MEDICINE.

During the year 1916 one new Anopheline was captured namely Anopheles squamosus. The larvae were found in a large permanent swamp about two miles outside the town. Adults of this species have not been taken in town, nor have any of those captured been engorged with blood.

As mentioned in my former reports A. costalis is the prevalent Anopheline throughout the two islands and is undoubtedly the chief vector of malarial parasites. On the other hand in certain districts namely Mwera and along its river A. funestus is a very dominant species, in the local prison at Mwera numbers of A. funestus have been taken. This district has always had a most evil reputation for fever and it remains to be proved by dissection if A. funestus is more infective than A. costalis. Larvae of A. funestus abound in the backwaters and at the edge of the river, in this site a few larvae of A. costalis were found occasionally in detached pools after the river had fallen.

The Anopheline Fauna of Zanzibar now consists of the following species :—

Anopheles costalis.
Anopheles funestus.
Anopheles mauritianus.
Anopheles squamosus.

Of these A. costalis and funestus are well known Malaria carriers, regarding the other two species engorged females have not been taken. In the recognition of the larvae of these four species it is stil found difficult to differentiate between A. mauritianus and squamosus. During the year under review collections of adults have been made in various quarters and out-districts of the town. In all cases A. costalis was the dominant Anopheline. The seasonal prevalence of this Anopheline is well marked. There are certain permanent Anopheline breeding grounds outside, and on the periphery of the town; shortly after the rains set in, a chain of small swamps, pools, etc., are brought into being, which act as flight pools and are responsible for their eventual arrival in the town. During May and June Anopheline larvae are found in small numbers throughout the town; as their breeding grounds dry up the adults die off, to reappear during the next rainy season.

The P. M. O. who acted as M. O. H. for a part of the year has formulated various plans for eliminating as far as possible the flight pools formed in the rains and for attacking their nearest permanent breeding grounds.

Three other mosquitos of medical interest are found in the town namely:—

Culex fatigans.
Stegomyia fasciata.
Ochlerotatus pembaensis.

Of these three *C. fatigans* is the most abundant, in fact over 80 per cent of mosquitos caught are of this species. In former reports relating to the distribution of mosquito larvae, S. fasciata always headed the list and an erroneous idea was formed that this mosquito was our dominant town species. The reason for this fallacy is that the finding of S. fasciata larvae is easy, while on the other hand the larvae of C. fatigans are generally found in enormous numbers in cesspools, which in the majority of cases are sealed and inaccessible to the larva dipper. The larvae of this species show a special liking for foul and putrid water. In nearly all instances cesspools contain pure cultures of C. fatigans and only occasionally have S. fasciata larvae been found in association with them, probably washed down with roof water into the cesspool. The larvae of Pericoma meridionalis are common associates of C. fatigans.

Practically all houses in Zanzibar town are of necessity furnished with cesspools and cesspits into the former of which roof, kitchen, and bath waters drain. The roof of such cesspools are frequently broken, more often than not a direct opening leads into the cesspool, and pipe connections from upper floors are faulty affording easy entry for adult female mosquitos. If these cesspools are regularly oiled, or better still, some means devised to render them mosquito proof, the mosquito nuisance in town will be greatly reduced.

In comparing the distribution of adult mosquitos in the town proper and various other towns, villages, etc in the two Islands the preponderance of C. fatigans in old Arab towns such as Zanzibar and Chake-Chake, which are riddled with cesspools, is striking.

C. fatigans not only is a most irritating, persistant biter, but above all is the vector of Microfilaria bancrofti. Elephantiasis is one of the commonest diseases in both islands and the number of natives harbouring Microfilariae with no apparent filarial symptoms is remarkable. I have had a native under observation for two years whose blood during this period invariably showed a heavy infection with Microfilaria bancrofti; a large number of C. fatigans have been collected from his house and dissected, over 72 per cent were infected. Numbers were kept in captivity from 12 to 14 days, the majority developed a proboscis infection. Many others have been collected from various quarters including both the European and Native hospitals; a number of these were found to be infected. These data together with the opinion of the P. M. O. that Filariasis is increasing, show the extermination of C. fatigans to be a matter of great urgency.

Stegomyia fasciata.—The larvae are ubiquitous being most commonly found in household utensils, earthenware pots, tins, etc. Some of their rarer haunts are step holes cut in the trunks of coconut trees and hollows in mango trees. The larvae of this species are rarer in native villages, although found in small numbers. Experiments were made by exposing earthenware jars away from human habitations in the bush; they did not become infected with larvae of S. fasciata, although various sylvan species of Culicines were obtained.

As regards S. faciata being a carrier of Microfilaria bancrofti, adults were fed on a patient showing a heavy infection of Microfilariae, 9 days afterwards Microfilariae were found in the thoracic muscles, no proboscis infection occurred. Wild Stegomyae have been captured showing thoracic infection on several occasions.

Ochlerotatus pembaensis.—Adults of this species are common in houses situated near mangrove creeks and sea inlets. Their larvae abound in crab holes on the banks of tidal streams, and are able to withstand a high degree of salinity. Experimentally they thrive in water to which has been added 80 per cent of sea-water. The adults are on the wing and active at sunset attacking humans with avidity. The species seems to be confined to the sea littoral, no specimens have been obtained from inland waters. Larvae are long lived and grow slowly, the average length of larval life experimentally is 12 to 14 days. No records have been obtained as to the capability of this species of carrying Microfilariae, a number were dissected with negative results.

Experimental work with various Culicidae.—A small leguminous shrub Tephrosia vogelii, Hook (Swahili name Utupa Mbazi) is used by the natives as a fish poison. It was decided to try the effect of the leaves of this plant on mosquito larvae.

Fresh green leaves were pounded in a mortar and made into a pulp. Six half grown larvae of S. fasciata were added to a 1 per cent solution of this pulp in water. All dead in 12 hours.

Before this is tried on a large scale a number of experiments will have to be made to test the toxicity of the plant upon various domestic animals such as dogs, goats, and poultry.

In certain districts of the town old holes, pits, etc. are used by the natives as rubbish dumps; during the rains and for some considerable time afterwards they are filled with water. In the majority of cases owing to the putrescense of the water, evidenced by gas bubbles continuously rising to the furface, very few mosquito larvae were found, most of them C. fatigans. As no Anopheline larvae were found in the water a sample was taken and six adult larvae of A. costalis placed in it, all pupated and eventually hatched. It shows that Anophelinae are not partial to depositing eggs in very foul water, although the pit in question owing to its shallow edges would make an ideal breeding ground. Water on the other hand soiled with cattle excrement is very attractive to A. costalis.

Experiments were also undertaken with the larvae of C. fatigans to ascertain whether they would live and pupate in water to which a considerable amount of human ordure had been added.

Six mature larvae were placed in a glass containing a strong solution of human faeces, all pupated and hatched.

The following mosquitos have been taken and identified during the year :—

Anopheles squamosus, Theo.
Culex perfuscus, Edw.
Culex insignis, Cart.
Culex tritaeniorhynchus, Giles.
Ochlerotatus fulgens, Edw.
Ochlerotatus adersi, Edw.
Eumelanomyia inconspicuosa, Theo.
Stegomyia metallica, Theo.
Stegomyia simpsoni, Theo.
Eretmopodites chrysogaster var. subsimplicipes, Grah.

Muscidae.—Considering that Zanzibar is an oriental town, it is surprising how few flies are existent. At certain seasons of the year generally during the rainy season the common house-fly (Musca domestica) makes its appearance in considerable numbers and becomes a nuisance in the residential part of the town. In my opinion the reason is that rubbish, road and market sweepings soaked with rain accumulate for some days on the drying floor at the destructor. Such rubbish when examined shows countless numbers of larvae and the soil floor of the drying shed reveals swarms of pupae. I have recommended that the floor of the drying shed should be cemented; this would in all probability prevent or hinder the putation of the larvae. On the other hand in the dry season when all rubbish can be coped with daily an immediate diminution of flies is noticeable.

The markets are always more or less infested with various species of Muscidae, the most prevalent being the Pycnosomidae and Sarcophagaidae. A number of places on the beach near the Town are used by the natives for defaecating; collections of human excrement from these areas were examined and proved to be swarming with larvae of M. domestica and other as yet unidentified Muscids.

Larvae of M. domestica and Stomoxys calcitrans are common in cow-dung manure in various market gardens. Owing to being situated well outside the Town they can hardly be considered a nuisance except that they may be instrumental in spreading Ankylostomiasis.

ENTOMOLOGY IN RELATION TO VETERINARY SCIENCE

Pycnosoma bezzianum, Villeneuve.—Larvae of these flies have been obtained in great numbers in sores from donkey's ears, generally associated with extensive necrotic suppurating areas.

Pupal stage averages from 5 to 6 days.

No other insects injurious to stock have been obtained during the year

ENTOMOLOGY IN RELATION TO AGRICULTURE.

During the year 1916 there has been no serious outbreak of any insect pests.

Only one pest of importance has been discovered namely the Mediterranean Fruit Fly, Ceratitis capitata. The distribution of this fly does not seen at present to be very widespread. Oranges and Mandarins of imported varieties growing on the Government plantation at Migombani were found to be infected. Native grown trees both Oranges and Mandarins seem to be far less susceptible.

Our list of insects injurious to Citrus has become considerable, and some must be studied.

In former reports I have mentioned various injurious Coccidae, in some instances good results have been obtained by spraying with fish oil.

The control of the Mediterranean Fruit Fly is a much more serious problem and this fly may in the future become a menace to the Citrus industry.

Coconuts.—No new pests have been discovered during the year.

I have received reports that the Rhinoceros Beetle (Oryctes monoceros and boas) is prevalent and doing damage in Pemba.

Presumably when a more favourable time presents itself, work will be started with traps.

GENERAL ZOOLOGY.

Owing to the importance of Mollusca in relation to the distribution and control of Bilharziosis, a collection of them was made from ponds, streams, and rivers in various parts of the island. Six species have been identified:—

1. Lanistes purpureus.
2. Ureodoxis gagates.
3. Meladomus olivaceus.
4. Melania amarula.
5. Ampullaria gradata.
6. Cleopatra ferruginea.

Of these Lanistes purpurous and Melania amarula are by far the commonest. As soon as a suitable case of Bilharziosis is found experiments will be made with our various local Molluscs as to their capacity for infection with the Miracidia of Bilharzia haematobium. This should be easy in the case of Lanistes purpurous, as its life cycle is well known and can easily be reared in captivity from eggs.

HELMINTHOLOGY.

A number of intestinal worms have been collected from various domestic animals, the following list comprises those which may play a part in causing disease.

Haemonchus contortus.—This common Nematode is abundant in local cattle and goats, in the latter it does not seem to cause any serious disturbance of health and the infection is generally scanty, on the other hand goats and sheep imported from Kismayu do not thrive in Zanzibar, in many cases after death the abamasum was found to be swarming with "Wire Worms." For many years past it has been known that sheep are not a success in Zanzibar, in fact few survive more than 6 months.

Oesophagostomum columbianum.—Is very prevalent in goats throughout the island, the disease is of a chronic nature accompanied by the formation of nodules on the walls of the intestine, a favorite site being the caecum.

Trichuris globulosa.—Countless numbers of these parasites have been found in camels imported for slaughter from Italian Somaliland. As far as could be ascertained no obvious clinical symptoms were observable.

Moniezia sp.—Frequently found in local goats.

Stilesia sp.—From local goats.

Cysticercus tenuicollis.—Common in local goats.

Dipylidium caninum.—This cestode is abundant both in pariah and European dogs.

Ankylostoma caninum.—A very common parasite in pariah dogs, being found in all autopsies. No records up to date have been obtained of this parasite in man.

Ankylostoma ceylanicum.—Obtained from pariah dogs.

Tanqua tiara.—From stomach of varanus sp.

No new birds or mammals have been indentified, a number have been collected and will be sent to the British Museum when a favourable opportunity offers.

The Museum of the Division has steadily increased, affording interest to many visitors.

No lectures or demonstrations were given this year, owing to stress of work outside the Health Office.

During the month of July, August and September (in the absence of the M. O. H.) I undertook at the request of the P. M. O. the examination of all blood films, faeces, etc. for portozoal or metazoal parasites.

Owing to my taking entire charge of the Veterinary Section under the supervision of the M. O. H. little time has been available for studying economic biological problems.

I am again indebted to Mr. Guy Marshall, Secretary to the Imperial Bureau of Entomology, and the experts of the British Museum, who have so promptly identified all material supplied to them.

W. M. ADERS,
Economic Biologist.